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MAR 12 1962
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BIOLOGICAL EVALUATION OF THE SOUTHERN PINE BEETLE EPIDEMIC IN SOUTHEASTERN TEXAS, MARCH 1962

Texas Forest Service
U. S. Forest Service, Region 8
Southern Forest Experiment Station

INTRODUCTION

This report has been prepared jointly by Leroy Williamson, Texas Forest Service; David E. Ketcham, Pest Control Section, U. S. Forest Service; and Wm. H. Bennett, Southern Forest Experiment Station. It concerns an outbreak of the southern pine beetle, Dendroctonus frontalis Zimm., in southeast Texas. The infestation started in late 1956 and early 1957 and now has reached epidemic proportions.

Texas Forest Service and industrial foresters have followed infestation trends during bi-weekly detection flights and subsequent ground checks. Pest Control Section entomologists have carried out project reviews by aerial and ground inspections. Robert C. Thatcher, Southern Forest Experiment Station, and Williamson have made evaluations in the form of frequent field sampling and research in study plots. Thatcher also has conducted detailed biological and population studies of material brought into the laboratory from the epidemic area.

The history of the southern pine beetle in the area has been marked by intermittent epidemics, the last of which terminated in 1951. For several years thereafter, Federal entomologists and State and industrial foresters constantly watched for a recurrence of the insect. Except for occasional infested logs on one skidway near Honey Island, they were unable to find signs of its presence.

In January 1957, however, a localized infestation was discovered near the Honey Island skidway in tops left from a recent salvage cutting on a 10-acre burn. How many infested sawlog-size trees had been removed is not known, but thorough scouting revealed 8 infested pulpwood-size trees remaining on the area. These trees were immediately cut and sprayed with BHC in fuel oil. No beetle trees were found on other burned areas in the vicinity. In February a second fire occurred adjacent to the older burn. Nine more infested trees were located and treated, 7 of which were in the burned area and 2 in adjacent unburned timber. No more reports of the beetle were received, although all foresters in east Texas were alerted to look for it.

An aerial survey in mid-September discovered an active infestation of 1-1/2 acres aproximately 2 miles southeast of Honey Island. Further

aerial observations in 1957 were made difficult by autum hardwood coloration, but ground inspections in December located fresh scattered attacks in the Honey Island area. Infested trees were more plentiful and more heavily attacked than earlier in the year. It was evident that the southern pine beetle was building up in east Texas.

Infestations increased steadily in the spring of 1958. Timber stands, weakened by several years of severe drought, were now subjected to prolonged flooding--some dying trees showed no signs of insect attack. The outbreak area involved at least 65,000 acres in Hardin County. It included several large industrial ownerships and numerous small holdings. In early May, additional spots were observed and further ground inspections confirmed the opinion that a serious situation was fast developing. At an emergency meeting, State, industrial, and Federal foresters and entomologists made plans for an aggressive control program in which the State, industry, ad the U. S. Forest Service would cooperate. The Texas Forst Service assumed leadership in the overall program, and cutting and spraying crews were organized and trained as quickly as possible.

During the summer, detection flights found many new spot infestations, which numbered over 60 at one time, and involved as many as 250 trees in a group. Ground inspections showed that these 'hot spots' were increasing rapidly and presented a definite threat to adjacent stands. Infestations were promptly treated with benzene hexachloride in fuel oil. Controls were very effective. By late July, aerial observers were unable to find fresh attacks. In mid-August, however, two small groups of infested pines were located in northeast Liberty County south of the outbreak area. In September, ten spots lacked control, one of which was outside the project area.

In 1959 the outbreak developed rapidly, and appeared over a larger and less accessible area than in 1958. One hundred thirty-five spot kills were located on approximately 70,000 acres in Hardin and Liberty Counties. Most spots were small, but several contained about 1,000 beetle trees. Heavy rains in late summer and fall made much of the area inaccessible and by winter over 30 spots remained uncontrolled. Beetles spread from these uncontrolled spots to scattered, single trees. From these overwintering brood trees, new infestations developed in the spring of 1960.

During the summer of 1960, more than 500 spot infestations (some covering 100 acres) on about 30 ownerships killed an estimated 10 million board feet of sawtimber and 30,000 cords of pulpwood. Wet weather handicapped control crews, but by September most of the outbreak appeared to be checked, and by late fall only about 4 small infestations remained. In December, however, fresh attacks were discovered on many sawtimber-size trees along 8 miles of power line right-of-way from Votaw toward Saratoga. Fresh branch stubs from recent heavy pruning and injury to trunks caused by climbing spikes had apparently attracted the beetles and rendered the

trees susceptible. The situation was considered to be better than at the end of 1959, when 30 spots remained uncontrolled, but existing populations were aggressive enough to cause future trouble.

The epidemic reached alarming proportions in 1961, when beetle populations appeared to explode. By August, over 700 beetle spots had been detected and at least 300 lacked control. Many new spots developed during September and expanded or combined to take in large acreages. Company control efforts were inadequate in curbing this high level of activity. In some instances, all control crews for a particular company were concentrated on one or two infestations leaving other areas to spread. In other cases, available manpower was distributed too thinly over a greater number of rapidly expanding infestations. By late fall, when wet conditions again hampered control, hundreds of untreated spots, many of them extensive in size, were left to provide a source for additional infestation during the winter and spring.

The epidemic area now includes parts of Hardin, Liberty, Polk, and Tyler Counties. More than 321 uncontrolled spots occur on an area of about 600 thousand acres. In addition there are an undetermined number of scattered, green-topped infested trees that cannot, at this time, be detected from the air. There has been no substantial buildup of natural enemies of the southern pine beetle, and it would appear that a still more serious situation is in prospect for 1962.

TECHNICAL INFORMATION

Causal agent and host.-- The insect epidemic in east Texas has resulted from repeated infestation by the southern pine beetle. Host species in this area are loblolly (Pinus taeda L.), shortleaf (P. echinata Miller), and occasionally longleaf (P. palustris Miller) pines.

Type of damage.-- In successfully attacked trees, southern pine beetles construct egg galleries beneath the bark in the phloem and cambium tissue; trees are killed by girdling. A blue stain fungus (Ceratocystis spp.) introduced by this insect, developes rapidly in the sapwood and facilitates death of the tree by cutting off water conduction. The value of salvable timber is reduced due to the presence of this fungus.

Biological data.-- Research plots were established in the southern pine beetle infestation area during the winter (1961-62) to study insect development and observe the status of the epidemic. The Southern Forest Experiment Station was assisted by the Texas Forest Service and industry in collecting data from these plots. Data were obtained from four plots at monthly intervals. Information compiled by Robert C. Thatcher and substantiated by his laboratory studies is pertinent to this evaluation and includes the following:

1. Egg galleries in sampled trees were consistently well dispersed indicating the possibility of high survival due to lack of intra-specific competition.

2. Woodpecker activity was very noticeable on infested trees; however, little control can be expected from these predators since many beetles are left in scored bark and removed chips.

3. Clerid larvae were noted in occasional trees in numbers up to 44 per sq. ft. of bark, but prospects of high southern pine beetle survival appeared to be good.

4. During December and January, brood development was slow; but it progressed at a spectacular rate through February. The increase in rate of development presumably resulted from an extended period of unseasonably warm weather during the month.

Natural control factors have had no notable effect on the southern pine beetle population during the present epidemic. There are five insect predators and five parasites of the southern pine beetle known in this area, but their effectiveness at present appears to be limited. The Southern Forest Experiment Station has initiated a study on the biology of a clerid predator. A fungus which inhabits the galleries of the southern pine beetle will also be studied in the near future.

Environmental conditions.-- Much of the infestation area has a shallow, heavy clay subsoil which becomes extremely dry during short periods of deficient rainfall and flooded during periods of heavy rainfall. Most of the area remains inundated during the winter due to poor drainage; both surface and internal. This situation limits control operations, and accessibility during wet periods is a major problem.

Infestations have occurred in timbered areas where adjacent rice field terraces have caused flooding. In some infested areas salt water waste from oil fields floods the timber land at intervals. Seemingly healthy trees have been overcome by heavy attack.

The relationship of soil moisture to tree vigor and insect attack has not been intensively studied, but there is evidence that the factors involved are important in southern pine beetle outbreaks.

Present status of the epidemic.-- By December, 1961, the infestation area covered approximately 600 thousand acres in the Big Thicket area of east Texas. During the year, 966 infestations were located by the Texas Forest Service on aerial detection flights; 113 spots remained uncontrolled on December 31, 1961. On January 16, 1962, a flight was made and 41 new infestations located. On February 20, adverse weather conditions prevented

full coverage of the infestation area; 113 new infestations were located in one-half the area. On the March 5 flight, 82 infestations were located. At the time of this report a total of 321 infestations remain uncontrolled.

Infestations are being found outside the 1961 boundaries, and the southern pine beetle population appears to be increasing rapidly.

DISCUSSION

The situation in southeast Texas is out of hand. In spite of control efforts, 113 multiple-tree spot infestations containing an estimated 100 thousand brood trees remained untreated at the end of 1961. The size of the infestation area increased from an estimated 200 thousand acres in 1960 to approximately 600 thousand acres at the end of 1961. Flights made by the Texas Forest Service in 1962 indicate that the infestation is slowly enlarging and endangering valuable timber resources to the north and the west.

Control efforts were considerably hampered by heavy rainfall which occurred periodically throughout the summer of 1961. Since the major portion of the epidemic area is underlaid by poorly drained soils in the Byars and Rains Series, access was greatly reduced during these wet periods.

Because the southern pine beetle is capable of reproducing at the rate of at least 10:1 per generation and has 6 or more generations per year in southeast Texas, control efforts have not kept pace. If future losses are to be reduced to an acceptable level, the approach toward control must be re-examined. Two opportunities for attack are possible under the current conditions. These are:

(1) To increase the control force to a level that will permit control of all known infestations within a 2-week period following detection.

(2) To divide the epidemic area into priority zones with primary emphasis on preventing the spread of the infestation into high-valued stands to the north and the west.

In the first case, the large backlog of uncontrolled spots would have to be treated immediately. Since the southern pine beetle completes its life cycle 30 to 40 days during warm weather and is now increasing at a rate of about 10 to 1, a tremendous workforce would have to be employed even to hold the insect population at its current level. Control efforts would have to be still more intensive to reduce the population. This could not be a 'one-shot' operation: control would have to continue at a high level until natural factors could again hold populations at an endemic level. Poor accessibility alone could defeat this type of an operation.

In the second case, the primary objective would be to prevent the spread of the epidemic into the high-valued stands to the north and the west. This objective could be accomplished as follows:

(1) Divide the epidemic area into priority zones on the basis of:

   a. Accessibility
   b. Timber values
   c. Direction of spread

(2) Concentrate all control crews treating zones of highest priority first.

(3) Enough crews should be in operation so that all spots within the zone being worked on could be completed within a 2-week period at the longest.

(4) As soon as all spots had been treated within a zone, the zone of next highest priority could be included. All spots in a zone must be treated before including additional area.

(5) Control efforts must be maintained on a priority basis; i.e. if crews were working in Zone 2 and several new spots were discovered in Zone 1, the spots in Zone 1 would have to be treated before continuing work in Zone 2.

In both cases, all landowners must participate at the same time if the control effort is to be entomologically sound.

Although salvage is an effective control measure for bark beetles which have 1 or 2 generations per year and where only merchantable timber is infested, it has not proved effective during the current epidemic of southern pine beetle in southeast Texas. The reasons for this are as follows:

(1) Due to the soil types, infestations are not accessible to logging equipment for long periods of time during wet weather.

(2) Salvage is much slower than chemical treatment and larger crews are necessary, thus reducing its effectiveness against such a dynamic insect as the southern pine beetle.

(3) Since only merchantable products are removed, large amounts of infestd, unmerchantable material are left in the woods. Salvage done in this manner is completely ineffective as a control measure.

(4) Unless infested bark from products salvaged is destroyed immediately, this operation tends to spread the infestation and intensity the problem.

For these reasons, salvage and brood-tree utilization cannot be considered as a control measure under current conditions. However, salvage should be encouraged following control so that residual values of the treated products can be realized. Wood treated with BHC in the manner specified for southern pine beetle control remains sould for a much longer period than does untreated wood.

RECOMMENDATIONS

After careful consideration of the factors involved in the current epidemic and control operation -- such as size of the epidemic area, accessibility, the number of infested spots located on the last flight, and the biotic potential of the insect -- we feel that the epidemic area should be divided into priority zones withthe primary objective being to prevent the spread of the epidemic into the high-valued stands to the north and the west. To continue trying to attack the beetle over the entire area would be entomologically unsound due to intermittent accessibility and other factors.

In order to limit the epidemic to its present boundries, the following zones should be considered (see figure 1):

(1) Zone I - north of the Santa Fe Railroad between the Neches River and the Trinity River.

(2) Zone II - west of the Trinity River.

The area north of the Santa Fe Railroad is suggested and given top priority for the following reasons:

(1) It is the most accessible throughout the year.

(2) The primary direction of spread of the epidemic is to the north.

(3) High timber values are threatened.

(4) The hardwood bottoms along the rivers on the east and west provide good buffers.

The area west of the Trinity River is suggested for similar reasons. Both areas provide excellent opportunities for control. After these areas have been secured, the epidemic will be re-evaluated.

Only chemical control measures applied in accordance with U. S. Forest Service and Texas Forest Service recommendations should be used. Salvage should be encouraged both in and out of the priority areas, but it should not be considered as part of the control effort. Salvage should be organized so as not to jeopardize the success of the control operation and may need to be postponed in a zone until control is complete. All landowners must participate completely if the control effort is to be entomologically sound.

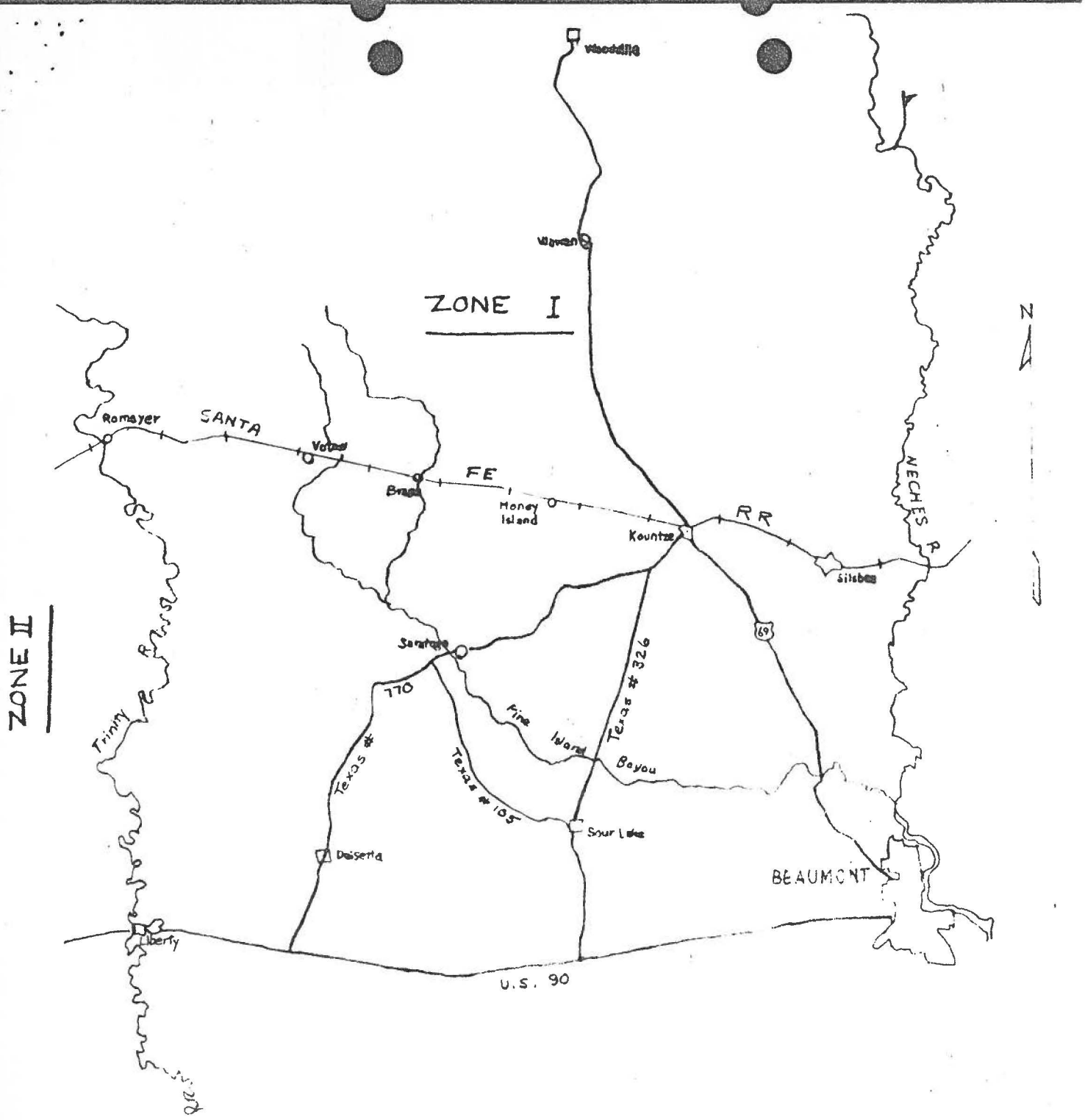

Figure 1. Map of epidemic area showing zones of top priority.